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CANADIAN PATENT

PRODUCTION OF HOLLOW BODIES BY PRESSING

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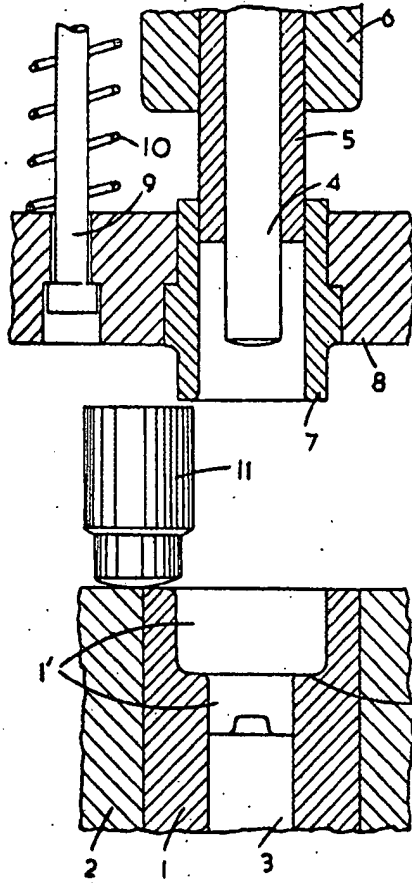


FIG. 1.

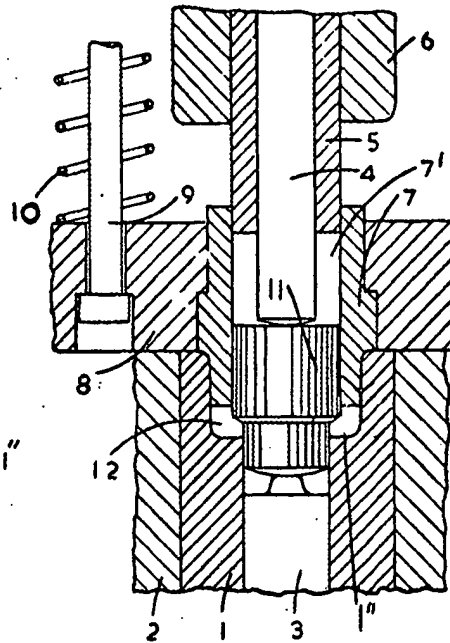


FIG. 2.

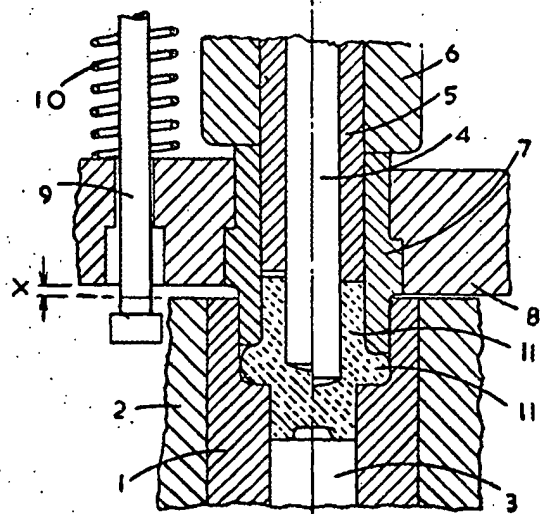


FIG. 3.

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5 The invention relates to a method and apparatus for the production by cold pressing of hollow bodies of steel or other metal having an external flange, preferably of steel, as a result of deformation without removal of metal. Such hollow bodies have hitherto been made in a number of successive pressing operations, usually with the interposition of annealing. This method is very troublesome, time-consuming, and expensive.

10 The method according to the invention makes it possible to produce hollow metal bodies with a flange as a result of the cold-deformation of a blank, more particularly of steel, in a single operation. By giving an appropriate form to the tool which is used for carrying out the new method, the flange on the cold-pressed hollow
15 body can be given any desired shape and position.

According to the invention the method broadly includes the steps of placing the blank in a die provided with a radial or lateral recess, causing the central portion of a stepped punch, during an initial portion of the single
20 pressing operation, to engage a central portion of the adjacent end face of the blank and, by penetrating into, or through it axially, simultaneously to displace a part of the material of the blank into the die recess and another part of the material backwardly into an annular space between the
25 central portion of the punch and the die, whereby to provide the blank with a roughly formed flange on its exterior and with an axially-directed annular wall about its said adjacent face, and then, during a final portion of the single pressing operation, to cause an annular punch, forming an end wall of
30 the recess, to engage the outer end of the annular wall of the

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blank to force the material into final forming contact with the wall of the said recess.

According to another aspect of the invention the method includes the steps of placing the blank in a die adapted closely to receive the inserted end of the blank but having an outer end of greater diameter than the blank, causing an annular punch, during an initial portion of the single pressing operation, to enter the annular space between the outer end of the die and the blank to define an end wall of an annular recess around the blank, and then, during an ensuing portion of the single pressing operation, causing the central portion of a stepped punch to engage a central portion of the adjacent end face of the blank and, by penetrating into, or through it axially, simultaneously to displace a part of the material of the blank radially into the recess, whereby to provide the blank with a roughly formed flange on its exterior, and axially into an annular space between the annular punch and the central portion of the stepped punch, whereby to form an axially-directed wall about the said adjacent face of the blank, and then, during a final portion of the single pressing operation, to cause the adjacent end of the annular punch, and the step of the stepped punch, to force the material into final forming contact with the wall of the said recess.

A tool for carrying out the invention comprises a one-piece die, an annular punch which is adapted to be moved into the end of an annular space formed between an inserted blank and the adjacent wall of the die so as to close this space and form an end wall of an annular recess, and a perforating punch, the latter being stepped and having

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a central portion which is adapted to be forced axially against the middle of the blank to penetrate or perforate it axially so as to displace material into the annular recess to form a flange on the blank, and into an annular space between the annular punch and the central portion of the perforating punch whereby to form an axially-directed annular wall on the blank, the arrangement being such that the annular punch and the step of the perforating punch force the material into final forming contact with the walls of the annular recess, and that after the withdrawal of the annular punch from the one-piece die the flanged hollow body can be removed from the die by pushing it out of one end.

One way of carrying the invention into effect is illustrated, by way of example, in the accompanying drawings, in which:-

Figure 1 is a cross-section through an example of a tool for carrying out the method of the invention, suitable for use in a single-acting press and with the parts shown in an initial position;

Figure 2 is a similar view of the tool as it is at the beginning of the pressing operation;

Figure 3 is a similar view but showing the parts in two different stages of the pressing operation.

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Referring to the drawings, 1 indicates the one-piece (i.e. unsplit or undivided) die which is secured in the reinforcement 2, the stepped bore 1' of the die being closed at the bottom by the counter-punch or end-support 3. The reinforced die 1 is secured in a known manner on the table of the press. The press-tool further consists of a punch 4, which is disposed axially in the press and serves for the perforation of the blank 11 inserted in the die, and an annular punch 7. The punch 4 is mounted in a bush 5 and secured together with the latter in the head 6 of the press. The bush 5 and punch 4 form a stepped press punch. The punch 4 is guided by means of the bush 5 in the annular punch 7. The annular punch 7 is secured within the plate 8 and moreover is so made and arranged that during the pressing operation it closes the opening of the die, i.e. the annular space formed between the wall of the die and the upper part of the inserted blank 11. The annular space 12 (Figure 2) remaining between the shoulder 1" of the die and the end face of the annular punch 7 serves for the reception of the blank metal for the formation of an outer flange 11', as may be seen from Figure 3. The carrier 8 of the annular punch 7 is connected, by means of studs 9 with the interposition of compression springs 10, to the head 6 of the press. By reason of the fact that the punch 4, which serves for effecting perforation, is guided in the annular punch 7 by means of the sleeve or bush 5 which receives it, an annular space 7' is formed above the inserted blanks 11, in which space a part of the material of the blank can rise axially during the pressing

operation.

The above-described press-tool operates as follows:-

A blank is inserted into the one-piece die 1, the blank being in the form of a section of rod or bar or of a stepped rough pressing 11, as is illustrated in Figures 1 and 2. On the downward movement of the head 6 of the press, the punch 4, 5 and the punch 7 are carried down until the carrier 8 of the annular punch 7 comes on to the die 1, as is illustrated in Figure 2. In this position of the parts, the annular punch 7 is disposed in the annular space between the blank 11 and the wall of the die, so that the annular space 12 which serves for the formation of the flange is closed at the top. The actual pressing operation begins with further downward movement of the head 6 of the press, the punch 4, which with the brush 5 is now driven alone, engaging the middle area of the blank 11 and, as a result of perforating it, displaces the material radially and axially into the annular spaces 7' and 12 and against the counter-punch 3. The blank then assumes the form to be seen from the left-hand half of Figure 3, in which it is shown with the flange 11' roughly formed and with an axially-directed annular wall. As soon as the annular space 12 is to some extent filled by material, the annular punch 7 with its carrier 8 is raised, shortly before the end of the working stroke of the punch 4, as a result of the further radial displacement of material, by the

1 amount indicated at X, the springs 10 being compressed.
The head 6 of the press then comes against the upper
end face of the annular punch 7, which now receives
from the head of the press a downwardly-directed
5 pressure. As a result of this, and of the final portion
of the movement of the punch 4 and brush 5, the
radially-displaced material in the annular spaces 7'
and 12 is forced to fill these spaces completely, so
that the flange is given the desired final shape with
10 certainty. The finished-pressed hollow body with its
flange may be removed from the die 1 by pushing it
out of one end by means of the counter-punch 3.

By means of the press-tool according to
the invention there may be formed, by a single cold
15 pressing operation, hollow metal bodies having a
flange at the lower end (bottom) of which is provided an
extension of any desired formation.

The method described makes possible an economical
mass production of hollow bodies of any desired shape
20 having an external flange, especially from steel, as
a result of cold-forming in a single working operation.
As a result of appropriate formation of the die 1 and
of the annular punch 7, the flange 11' can be provided
as desired at the top, at the bottom or in the middle
25 of the hollow body.

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The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:-

- 1 1. A method of making a hollow body, having an
2 external flange, by a single cold-pressing operation on
3 a blank of steel or other metal, which includes the steps
4 of placing the blank in a die provided with a lateral recess,
5 causing the central portion of a stepped punch, during an
6 initial portion of the single pressing operation, to engage
7 a central portion of the adjacent end face of the blank and,
8 by penetrating into it axially, simultaneously to displace a
9 part of the material of the blank into the die recess and
10 another part of the material backwardly into an annular space
11 between the central portion of the punch and the die, whereby
12 to provide the blank with a roughly formed flange on its
13 exterior and with an axially-directed annular wall about its
14 said adjacent face, and then, during a final portion of the
15 single pressing operation, to cause an annular punch, forming
16 an end wall of the recess, to engage the outer end of the
17 annular wall of the blank to force the material into final
18 forming contact with the wall of the said recess.

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1 2. A method of making a hollow body, having an
2 external flange, by a single cold-pressing operation on
3 a blank of steel or other metal, which includes the steps
4 of placing the blank in a die adapted closely to receive
5 the inserted end of the blank but having an outer end of
6 greater diameter than the blank, causing an annular punch
7 during an initial portion of the single pressing operation,
8 to enter the annular space between the outer end of the die
9 and the blank to define an end wall of an annular recess
10 around the blank, and then, during an ensuing portion of
11 the single pressing operation, causing the central portion
12 of a stepped punch to engage a central portion of the
13 adjacent end face of the blank and, by penetrating into it
14 axially, simultaneously to displace a part of the material
15 of the blank radially into the recess, whereby to provide
16 the blank with a roughly formed flange on its exterior, and
17 axially into an annular space between the annular punch and
18 the central portion of the stepped punch, whereby to form
19 an axially-directed wall about the said adjacent face of the
20 blank, and then, during a final portion of the single
21 pressing operation, to cause the adjacent end of the annular
22 punch, and the step of the stepped punch, to force the
23 material into final forming contact with the wall of the
24 said recess.

1 3. A tool, for making a hollow body, having an
2 external flange, by a single cold-pressing operation on
3 a blank of steel or other metal, comprising a one-piece
4 die, an annular punch which is adapted to be moved into
5 the end of an annular space formed between an inserted
6 blank and the adjacent wall of the die so as to close this
7 space and form an end wall of an annular recess, and a
8 perforating punch, the latter being stepped and having a
9 central portion which is adapted to be forced axially
10 against the middle of the blank to penetrate or perforate
11 it axially so as to displace material into the annular
12 recess to form the flange on the blank, and into an annular
13 space between the annular punch and the central portion of
14 the perforating punch whereby to form an axially-directed
15 annular wall on the blank, the arrangement being such that
16 the annular punch and the step of the perforating punch
17 force the material into final forming contact with the
18 walls of the annular recess, and that after the withdrawal
19 of the annular punch from the one-piece die, the flanged
20 hollow body can be removed from the die by pushing it out
21 of one end.

1 4. A tool according to Claim 3, in which the
2 annular punch is first adapted to be moved in advance of the
3 perforating punch but is arrested by a stop or the like
4 after it has entered the annular space between the blank
5 and the wall of the die, while leaving the perforating punch
6 able to continue its movement.

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5. A tool according to Claim 4, in which the perforating punch and the annular punch are so connected together by means of springs that after the annular punch has come into contact with the die, the perforating punch is able to continue moving alone against the action of the springs.

6. A tool according to Claim 5 in which the springs are such that the annular punch is adapted to be moved back by a short distance in the axial direction shortly before the end of the stroke of the press by the material which has been radially displaced into that space, and is then again moved forward with the perforating punch towards the end of the stroke to give the flange its final form.

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